3.4 CANADA LYNX (Threatened and Endangered Species)

3.4.1 Introduction

The Canada lynx is a federally protected species that occurs on the forest. Federal protection under the Endangered Species Act obligates the Forest Service to manage its lands to aid in lynx survival and recovery.

Issue: During project scoping, the public expressed concerns that harvest and related road activities have the potential to affect lynx and its habitat. In particular the project would create unsuitable habitat and would fragment lynx habitat. Habitat important for lynx movement across the landscape (connectivity) would be impacted. Movement of lynx between suitable habitat in the project area and the BWCAW, considered lynx refugia habitat, would be impaired. New roads and winter trails could impact lynx by increasing the risk of human related mortality and by creating areas of compacted snow that could increase competition from other carnivores. In addition, the public raised a concern about the impact of the project on proposed critical habitat for the lynx.

3.4.2 Summary

Maintaining or improving habitat for the lynx was one of the drivers in the development of the Glacier project and its proposed action. The interdisciplinary team considered the needs of the lynx upfront in order to protect the species and avoid adverse effects. Alternative 3 was developed in an effort to further address the concerns raised by the public in regards to lynx.

Forest Service biologists conducted a Biological Assessment (BA) to determine the impact that this project would have on Canada lynx. The BA found that all alternatives may affect the lynx to varying degrees however; these effects would be either insignificant related to the size of the impact or extremely unlikely to occur (no adverse effects). Of the action alternatives, all alternatives would maintain adequate amounts of habitat for important prey species, and lynx denning habitat. Alternative 4 would result in the greatest change to lynx habitat and alternative 3 the least. Although the amount of unsuitable habitat would increase with the action alternatives, the amount would remain below accepted thresholds; therefore, the lynx would not be adversely impacted. As a result of the tens of thousands of acres not harvested with this project, adequate amounts of habitat for lynx movement throughout the area (connectivity), and between the project area and refugia habitat in the BWCAW would be maintained with all alternatives. The impact of road related activities from this project would be minimal. This is because few roads would be added to the system and few would be decommissioned. Also, all temporary roads would be closed to public use and would be decommissioned upon completion of work. This project would not adversely impact proposed critical habitat because the physical and biological features that are essential to the conservation of the species would be maintained with all alternatives.

The US Fish and Wildlife Service (FWS) is the agency responsible for overseeing all activities related to species protected under the Endangered Species Act. Forest Service biologists have consulted with FWS throughout the project. FWS has reviewed the BA and have concurred with the analysis methods, effects and determinations.

3.4.3 Analysis Methods

Forest Service biologists conducted a Biological Assessment (BA) of the effects of project alternatives on lynx. The BA was used to communicate and consult on the effects of the project with the US Fish and Wildlife Service. The district ranger considers information from the BA as well as other

information provided in this document when comparing and selecting alternatives. The complete BA is located on the Superior National Forest web page at www.fs.fed.us/r9/superior/projects.

Nine indicators were used to analyze the effects of the alternatives on lynx (table 3.4-1). They were selected based on

1) Species' environmental requirements (*e.g.,* habitat quantity, quality, and spatial pattern), life history, and distributional range
2) Potential impacts of management activities
3) Potential risk factors
4) Usefulness to assess the effects to proposed critical habitat

On February 28, 2008, the Fish and Wildlife Service proposed revising the Canada lynx critical habitat designation to include all of the Superior National Forest (and other lands in Northeastern Minnesota) as critical habitat (USDI FWS 2008b). The selected analysis indicators also serve as appropriate indicators of effects to proposed critical habitat and its constituent elements. This is because the indicators address relevant *Primary Constituent Elements* of lynx habitat - those physical and biological features that are essential to the conservation of the species. The table below crosswalks the lynx indicators to the Primary Constituent Elements (PCE) of critical habitat.

Table 3.4-1. Indicators selected for Analysis of Effect to Lynx.

Indicator	PCE	Why selected
Habitat indicators: measures the effects to important forest vegetation conditions and spatial patterns that provide denning, foraging, or cover habitat for lynx or their key prey species		
Acres and percent of snowshoe hare habitat on Federal lands	a	Snowshoe hare is the primary prey species of lynx, and amount, quality, and distribution of its habitat can be impacted by vegetation management. This indicator is also useful to assess the following Forest Plan objectives: • Maintain or improve habitat (O-WL-4) • Seek opportunities to benefit species (O-WL-5) • Reduce or eliminate adverse effects (O-WL 6) • Promote recovery (O-WL-8) • Manage for hare habitat (O-WL-9) • Provide foraging habitat in proximity to denning (O-WL-10)
Acres and percent of red squirrel habitat on federal lands	d	Red squirrel is an important alternate prey species of lynx, and amount, quality, and distribution its habitat can be impacted by vegetation management. This indicator is also useful to assess the following Forest Plan objectives: • Maintain or improve habitat (O-WL-4) • Seek opportunities to benefit species (O-WL-5) • Reduce or eliminate adverse effects (O-WL 6) • Promote recovery (O-WL-8) • Manage for alternate prey habitat (O-WL-9) • Provide foraging habitat in proximity to denning (O-WL-10)

Table 3.4-1. Indicators selected for Analysis of Effect to Lynx.

Indicator	PCE	Why selected
Acres and percent of denning habitat in patches greater than 5 acres on federal lands	c	Denning habitat is important to lynx reproduction and survival, and amount, quality, and distribution of suitable denning habitat can be impacted by vegetation management. This indicator is also useful to assess following Forest Plan objectives and guidelines: • Maintain or improve habitat (O-WL-4) • Seek opportunities to benefit species (O-WL-5) • Reduce or eliminate adverse effects (O-WL 6) • Promote recovery (O-WL-8) • Provide foraging habitat in proximity to denning (O-WL-10) • Maintain at least 10% denning habitat (G-WL-4 and G-WL-5)
Acres and percent of connective habitat on federal lands	a, c, d	*Connective habitat* refers to vegetation cover in sufficient quantity and arrangement to allow lynx to easily move long distances in search of food, cover, and mates. This indicator is useful because the amount, quality and distribution can be impacted by vegetation management. This indicator is also useful to assess the following Forest Plan objectives: • Maintain or improve habitat (O-WL-4) • Seek opportunities to benefit species (O-WL-5) • Reduce or eliminate adverse effects (O-WL 6) • Maintain habitat connectivity (O-WL-11) • Participate in efforts to maintain linkage areas (O-WL-12) • In BWCAW, lynx habitat results from natural processes (O-WL-15)
Acres of snowshoe hare habitat in which within stand structure will be increased thru diversity and under-planting of conifer.	a	Allow us to compare beneficial site-specific effects of each alternative by increasing small diameter conifers and stand structure as a component of prey habitat. This indicator is also useful to assess the following Forest Plan objectives: • Maintain or improve habitat (O-WL-4) • Seek opportunities to benefit species (O-WL-5) • Reduce or eliminate adverse effects (O-WL 6) • Promote recovery (O-WL-8)
Acres and percent of unsuitable habitat on all ownerships (a cumulative effect indicator)	a, c, d	*Unsuitable habitat* is defined as areas of lynx habitat that are in initial stages of forest growth where vegetation has not developed sufficiently to support snowshoe hare populations during all seasons. This is a useful indicator because some type's vegetation management treatments can put lynx habitat into an unsuitable condition. This indictor measures habitat on all ownerships so it is useful for analyzing cumulative effects. This indicator is also useful to assess the following Forest Plan objectives and guidelines: • Reduce or eliminate adverse effects (O-WL 6) • Promote recovery (O-WL-8)

Table 3.4-1. Indicators selected for Analysis of Effect to Lynx.

Indicator	PCE	Why selected
		• Maintain habitat connectivity (O-WL-11 and O-WL-12) • In BWCAW, lynx habitat results from natural processes (O-WL-15) • No more than 30% of an LAU in unsuitable condition (G-WL-3)
Acres and percent change to unsuitable condition on NFS lands	a, c, d	This indicator is similar to the indicator above but just measures the amount of unsuitable habitat on Federal lands. It's primary use as an indictor is to measure a Forest Plan standard that directs that "there should be no more than 15% change to unsuitable habitat conditions in a 10 year period on NFS lands" (S-WL-1). This indicator is also useful to assess the following other Forest Plan objectives: • Reduce or eliminate adverse effects (O-WL 6) • Promote recovery (O-WL-8)
Human disturbance indicators: measures the effects of human access and potential disturbance		
Miles of temporary and low standard roads on federal lands	b	Low standard roads can negatively affect lynx by increasing the potential for human disturbance and human induced mortality. This indicator is also useful to assess the following Forest Plan objectives: • Reduce or eliminate adverse effects (O-WL 6) • Minimize building or upgrading roads (O-WL-7) • Promote recovery (O-WL-8) • Maintain (or improve competitive advantage of lynx (O-WL-13) • Reduce lynx mortality on roads (O-WL-14)
Road and compacted trail density on all ownership (mi/sq. mi) (a cumulative effect indicator)	b	High density of road and compact snow trails negatively effect lynx by increasing the potential for human disturbance and decreasing the competitive advantage of lynx in winter. This indictor measures all roads on all ownerships so it is useful for analyzing cumulative effects. This indicator is also useful to assess the following Forest Plan objectives and guidelines: • Seek opportunities to benefit species (O-WL-5) • Reduce or eliminate adverse effects (O-WL 6) • Minimize building or upgrading roads (O-WL-7) • Promote recovery (O-WL-8) • Maintain (or improve competitive advantage of lynx (O-WL-13) • Reduce lynx mortality on roads (O-WL-14) • Maintain road density below 2 mi/mi^2 (G-WL-8)

Proposed critical habitat for lynx is defined as boreal forest landscapes supporting a mosaic of differing successional forest stages and containing the following Primary Constituent Elements (PCEs):

a) Presence of snowshoe hares and their preferred habitat conditions, including dense understories of young trees or shrubs tall enough to protrude above the snow;
b) Winter snow conditions that are generally deep and fluffy for extended periods of time;
c) Sites for denning having abundant coarse, woody debris, such as downed trees and root wads; and
d) Matrix habitat (*e.g.,* hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx

Table 3.4-1. Indicators selected for Analysis of Effect to Lynx.		
Indicator	**PCE**	**Why selected**
home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range. The important aspect of matrix habitat for lynx is that these habitats retain the ability to allow unimpeded movement of lynx through them as lynx travel between patches of boreal forest.		

The analysis of indicators assumes that all activities would occur at nearly the same time thus representing the maximum effects that could occur. For example, the analysis assumes that all habitat put in an unsuitable condition would all be unsuitable at the same time. It is unlikely that all activities would occur at the same time but more likely to occur over a 5-10 year period. In reality, some stands that are cut would return to a suited condition before others are cut, thus lessening the effects. Due to the difficulty of predicting exactly which year stands would be harvested, conducting a worst case analysis is appropriate.

The analysis methods used in the BA are based on currently accepted and applicable scientific literature and other scientific sources, as well as information from species experts and professional judgment of Forest Service biologists. The key sources for Canada lynx information include Forest Plan FEIS, vol. 1, Section 3.3.4; vol. 2, p. B-29, Forest Plan Biological Assessment (USDA Forest Service 2004a, Forest Plan planning record #20690), and new relevant information (such as site specific surveys) collected for this project and documented in the BA. Where applicable the Glacier Project BA tiers to the Forest Plan Revision Programmatic BA with respect to defining elements of species' ecology and biology, risk factors and general effects, analysis parameters, monitoring, and management direction in the 2004 Forest Plan.

Determination of effects

The analysis of effects to the Canada lynx results in a "determination" on which of the following three conditions are most likely from the impacts of each of the alternatives. These include:

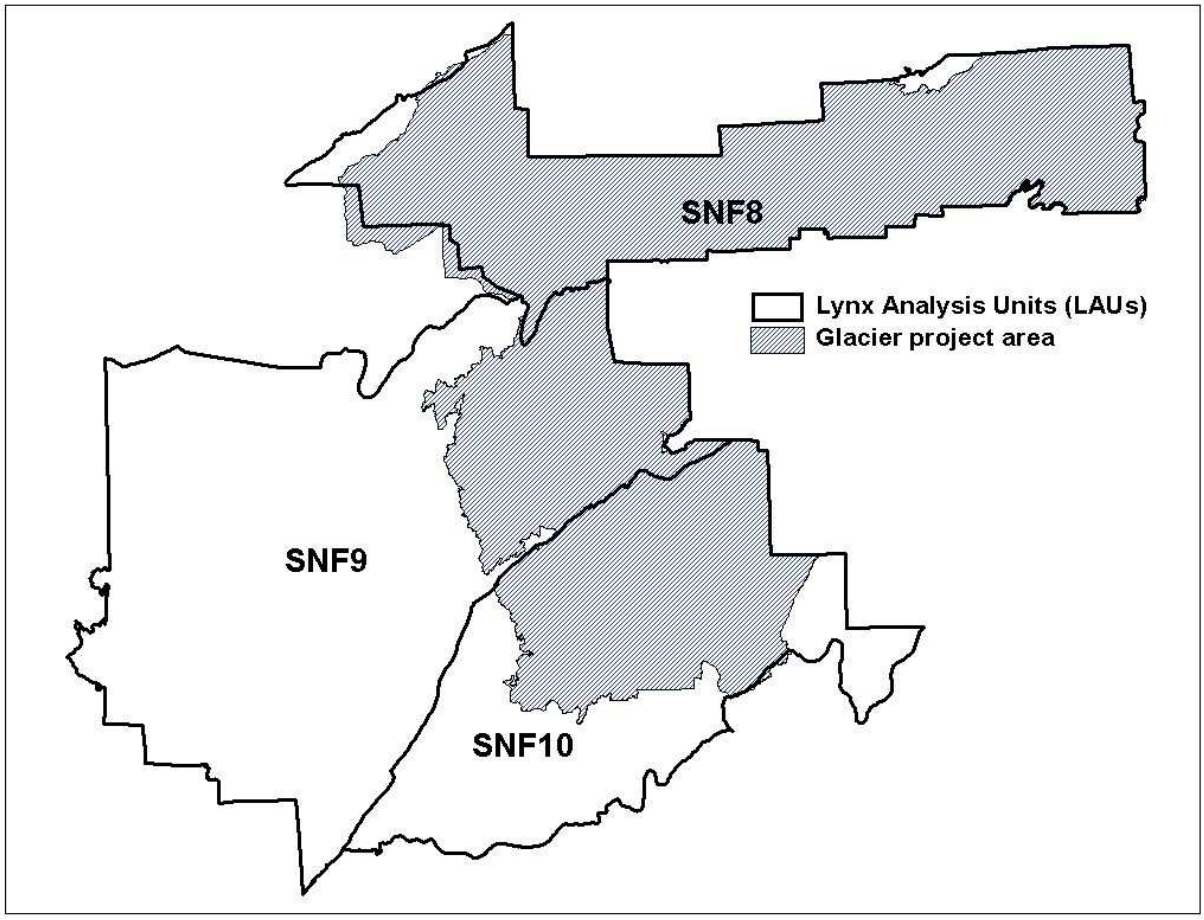
- *No Effect*
- *May effect but is not likely to adversely affect* – used when it is determined the proposed alternative may cause some negative effects, but they are expected to be discountable, insignificant, or completely beneficial.
- *May effect and is likely to adversely affect* – used if any adverse effect may occur as a direct or indirect result of the proposed alternatives and the effect is not discountable, insignificant or beneficial, or the effect will harm, harass or wound the species.

The determination of effects is used in consultation with the United States Department of the Interior (USDI) Fish and Wildlife Service to help them determine whether or not a proposed action is likely to jeopardize the continued existence of a listed species. The effects analysis and determinations are based on the assumption that all project design criteria and mitigation measures outlined in Appendices B and E would be followed during implementation.

3.4.4 Analysis Area and Time Scales for Analysis

The analysis area for direct, indirect and cumulative effects is the area that encompasses Lynx Analysis Units (LAUs): Superior National Forest (SNF) 8, SNF 9, and SNF 10 (see map 7). Individual Lynx Analysis Units represent a hypothetical lynx home range in size. See Superior National Forest Plan Appendix E: Canada Lynx Section 5. *Scales of Analysis*, pg E-3 for more detailed rationale for spatial LAU analysis boundaries. These particular LAUs were chosen as the analysis area because it is where proposed activities would occur, thus allowing for analysis to identify potential changes to habitat and the effects of human disturbance factors. It is also an appropriate analysis area because it allows for the analysis of lynx movement and habitat use within individual LAUs and between LAUs, and between LAUs and Lynx refugia habitat in the BWCAW. Direct and indirect effects consider all lands and roads administered by the Superior National Forest. Cumulative effects consider habitat and roads on all ownerships within the same LAUs. Using this same analysis area for cumulative effects allows for an analysis of the potential compounding effects of those activities with other activities planned or already occurring in the area regardless of ownership.

Figure 3.4-1: Location of the Glacier Project within Lynx Analysis Units SNF 8, 9 and 10



The time scale used for direct, indirect, and cumulative effects analysis examines effects that could occur during or immediately after activities up to 10 years after (2017). The 10 year analysis timeframe was chosen for the following reasons:

1) While it is likely that many of the proposed treatments would take place within three to five years after a decision is made, it could take up to ten years to complete all treatments (such as harvest, site preparation, planting and road decommissioning).
2) To account for the natural replacement, in time and space, of one plant community with another (succession). A 10 year time step provides a reasonable predictable measure of this dynamic. Succession was predicted based on modeling rules established for the Forest Plan Revision (see Forest Plan FEIS Appendix B pgs B-17 to B-18).
3) This time frame allows for a reasonable prediction of projects that could contribute to cumulative effects (past, present and reasonably foreseeable future).

3.4.5 Affected Environment

Lynx occur in mesic coniferous forest that have cold, snowy winters and provide a prey base of snowshoe hare (LCAS, 2000). Ample amounts of suitable habitat is available in the Glacier area and lynx are known to occupy the area based on telemetry locations, sighting information and snow tracking surveys (USDA Forest Service 2008, Glacier Project Biological Assessment). In addition, this project area is located within proposed Lynx Critical Habitat (USDI FWS 2008b). Important habitat components for lynx are abundant and fairly well-distributed throughout the area. Currently, 55% of the analysis area is in suitable condition for denning, 65% suitable habitat for snowshoe hare, 33% suitable habitat for red squirrel habitat (alternative prey species) and 94% of the area has adequate canopy cover (connective habitat) to allow for lynx movement and dispersal. All denning habitat is currently in patches greater than five acres and is within three miles of adequate foraging habitat.

The Forest Plan Revision Programmatic BA (USDA Forest Service 2004a, Forest Plan record #20690) identifies several potential risk factors to lynx. Those risk factors relevant to this project include:

- Forest management practices such as thinning, commercial harvest, road construction, and post harvest treatment influence habitats for lynx and prey.
- Forest road and trails may facilitate snowmobile and other human uses in the winter. Snow compaction of roads and trails may allow competing carnivores access into lynx habitat. In addition, recreational, administrative and commercial use of forest roads could disturb lynx.

Forest Plan direction provides a means whereby ecosystems upon which lynx depend, is conserved. The Forest Plan objectives relevant to this project are to (see Forest Plan for additional relevant Standards and Guidelines that apply):

- Promote the conservation and recovery of Canada lynx and its habitat (O-WL-8)
- Maintain, protect or improve habitat for the species (O-WL-4)
- Seek opportunities to benefit the species (O-WL-5)
- Reduce or eliminate adverse effects (O-WL-6)
- Minimize building or upgrading of roads in areas that are important for the species habitat and for habitat connectivity (O-WL-7)
- Within Lynx Analysis Units, lands should retain, improve or develop habitat characteristics

suitable for snowshoe hare and other important alternate prey (O-WL-9)

- Provide foraging habitat in proximity to denning habitat (O-WL-10)
- Maintain or restore sufficient habitat connectivity to reduce mortality related to roads and to allow lynx to disperse within and between LAUs and between LAUs and the BWCAW refugium on NFS land (O-WL-11)

In compliance with Forest Plan objectives, the habitat needs of the Canada lynx were considered in the development of the proposed action and alternatives for the Glacier Project. There were several concerns identified during the planning process.

1) Currently, the amount of suitable foraging habitat in proximity to denning habitat in the Bogberry, Omaday, and August Lakes area is sufficient however, vegetation management to meet other resource objectives could cause an undesirable outcome to distribution of these habitats.

2) Two Lynx Analysis Units (LAUs), covering the northern half of the project area, are above Forest Plan road/trail density recommendation due largely to the higher amount of nonfederal ownership.

3) Nearly ½ of the analysis area abuts lynx refugia habitat in the BWCAW. It was important to maintain sufficient connective habitat to allow for lynx movement throughout the area as well as between the area and refugia habitat. This is especially important in the Fernberg Corridor (Lynx Analysis Unit SNF 8) which is surrounded on 3 sides by refugia habitat.

With these concerns in mind, as well as all other habitat needs of the lynx, all alternatives were designed to protect and/or improve habitat conditions and to meet objectives, standards and guidelines important for lynx recovery.

More detailed information about population, habitat condition, trend and known risk or limiting factors, is documented in the Glacier Project Biological Assessment and the Forest Plan Revision Programmatic BA (USDA Forest Service 2004a, Forest Plan record #20690).

3.4.6 Environmental Consequences

3.4.6.1 Direct and Indirect Effects

The following section briefly summarizes the potential effects of each alternative on Canada lynx. Details of the analysis are documented in the Glacier Project Biological Assessment (Appendix G).

Indirect and cumulative effects would result from the alteration of vegetative habitat conditions. Direct, indirect and cumulative effects could also result from increased human access or disturbance. The focus in the analysis is on those condition changes that would pose a risk (limiting factors) to species from activities on the Superior National Forest, but beneficial effects are also analyzed.

Effects Common to All Action Alternatives

While the role of each alternative in managing Canada lynx habitat may vary (for example, different alternatives provide differing total amounts and quality of suitable habitat conditions), all proposed management activities are developed to generally meet Forest Plan direction to maintain, protect, or improve habitat and reduce or eliminate negative or adverse effects from activities (O-WL-4 through 15, S-WL-1 through 2, G-WL-1 through -9).

Vegetation Management

Vegetation management, whether through timber harvest, site preparation and reforestation, or from allowing forest succession may alter lynx habitat, prey habitat, or may influence their habitat in other ways: such as impacts to habitat caused by changes in hydrology - for example, increases in water yield due to upland timber harvest. Effects of these changes can be both short term and long term, and both positive and negative to lynx. These effects can also vary based on the amount, timing, location, or intensity of management activities. Effects generally may include the following:

- Even-aged harvest alters stand structure, and temporarily eliminates snowshoe hare forage/cover and lynx cover until the site is regenerated (typically 3-5 years for aspen types); It generally reduces potential for denning habitat by removing large trees and down logs from the site, and red squirrel habitat is also reduced by the harvest of large trees. Regeneration harvest can also create high quality snowshoe hare habitat in the future, especially where regeneration would provide dense young vegetation.

- Un-even aged management and intermediate treatment results in varying effects to snowshoe hare, red squirrel and lynx, depending on the trees removed, harvest systems and post sale treatments. These treatments may temporarily reduce cover and forage values for lynx, and reduce winter forage opportunities for snowshoe hare. These treatments can also modify vegetation structure that contributes to red squirrel habitat, both positively and negatively. The degree of tree removal determines whether snowshoe hare habitat is improved or restored by subsequent reinitiation of understory conifers and shrubs. Habitat for denning and cover for lynx movement are minimally impacted by these types of treatments.

- Harvest in general can potentially harm, kill, displace, or temporarily disturb lynx especially during the denning season.

Road Management

Roads and trails may present several risks to lynx, depending on their distribution over the landscape, their accessibility, the season of use, and intensity and frequency of use. Road management may result in impacts to lynx and their habitat including both direct and indirect effects associated with construction and maintenance of permanent and temporary roads. New trails may also impact lynx. Generally these effects may include:

- Construction and maintenance may harm, kill, displace, or temporarily disturb lynx.
- Construction may reduce lynx habitat by removing forest cover. In contrast, in some instances, along less-traveled roads where vegetation provides good snowshoe hare habitat, lynx may use the roadbed for travel and foraging

- Roads and trails facilitate snowmobile and other human uses in the winter. This contributes to snow compaction on roads which may allow competing carnivores access into lynx habitat.
- Recreational, administrative and commercial use of roads can disturb lynx, especially during the denning season
- Lynx may be more vulnerable to human caused mortality (shooting, trapping, vehicle collision) near open roads

Alternative 1

Direct/indirect effects

With alternative 1, no harvest would occur and forested habitats would be allowed to grow and succeed. Following is a discussion of the indicators that can be found in table 3.4-2 *Lynx Habitat – Forest Condition Indicators* and Table 3.4-3 *Lynx Habitat – Human Disturbance/Access Indicators*. Based on the analysis indicators and risk factors, this alternative would have minimal effect on lynx or proposed critical habitat.

Habitat

Snowshoe hare habitat – As a result of forest succession, the amount of habitat suitable for snowshoe hare would decrease slightly in two Lynx Analysis Units (SNF 8 decreased by 3% and SNF 9 decreased by 4%). This change however would be insignificant because it is a very small amount and the majority of snowshoe hare habitat would continue to occur in these LAUs (77% and 69%). Overall the amount of hare habitat would increase from what is currently available and remain abundant and well distributed throughout the entire analysis area (67%).

Red squirrel habitat– There is an expected increase in the amount of red squirrel habitat, however very slight. Suitable squirrel habitat would continue to be most abundant in the southern ½ of the analysis area (46% in SNF 10).

Denning habitat– The amount of available denning habitat is also expected to increase by a small amount (2%) in the center portion of the analysis area (SNF 10). With this alternative, the proximity of denning habitat to foraging habitat would remain virtually unchanged from the existing condition, where all denning habitat is currently within 3 miles of foraging habitat.

Connective habitat– Nearly all (94%) of lynx habitat in the analysis area would have adequate canopy (connective habitat) to allow for un-impeded lynx movement on federal lands throughout the area and between LAUs and refugia habitat in the BWCAW. The amount of denning habitat and connective habitat would remain abundant and will distributed, including in the Bogberry, Omaday and August Lakes area which was an area of concern identified during project planning.

Overall, the effect of these changes in lynx habitat with alternative 1 is expected to be insignificant. This is because important habitat components would remain abundant (or increase from current conditions) and remain well distributed. This means that ample habitat for lynx and important prey species would be maintained in this alternative.

Human disturbance

Miles of low standard roads - With this alternative higher level of open, low-standard roads would persist throughout much of the analysis area. This means that lynx that occupy this area may have less

competitive advantage and may be more susceptible to mortality due to roads than other locations across the forest where road densities are lower. The effect of roads is expected to be small because lynx do persist in the area with the current level of low standard roads, and with the project areas adjacency to the BWCAW lynx can find refuge where roads are not a factor.

Alternatives 2, 3 and 4

Direct/indirect effects

The effects of the action alternatives are summarized as a group because, in general, their impacts are similar. This is because total amounts, percent, miles, number of management activities, and other quantitative or qualitative indicators of effects vary by relatively minor amounts, location, or intensity of management (see analysis in the Glacier Project Biological Assessment). Table 3.4-2 shows that all alternatives maintain similar amounts of snowshoe hare and red squirrel habitat and similar amounts of denning habitat and Table 3.4-3 shows that all alternatives would have similar amounts of roads. Following is a detailed comparison between effects of the alternatives. In general, alternative 4 would result in the greatest changes in lynx habitat and alternative 3 the smallest.

Habitat

Snowshoe hare habitat– Regeneration harvests proposed with all alternatives would temporarily reduce (up to 4% reduction with alternative 4) the amount of suitable snowshoe hare habitat that would occur with alternative 1. The effect of this change however is expected to be insignificant because 1) hare habitat would still remain abundant and well distributed, 2) the change would be short term (3-5 years), 3) project design criteria for leave trees would maintain some suitable habitat components in harvested stands (see Appendix E), and 4) within stand structure would be increased through the diversity and under-planting of conifers resulting in improved snowshoe hare habitat in the future.

Red squirrel habitat– Suitable habitat for red squirrel would remain relatively unchanged with alternatives 2 and 3. With alternative 4 there would be a slight decrease (2%) mostly occurring in SNF 8 which is the Fernberg Corridor area. The effect of this change is expected to be insignificant because 1) ample snowshoe hare habitat occurs in SNF 8, 2) the amount of suitable squirrel habitat would be equal to what is available today and 3) the change is small and red squirrel habitat would sill be abundant in the southern ½ of the analysis area where it is ecologically better suited to support red squirrel habitat.

Denning habitat – The amount of available denning habitat would decrease with all alternatives, with alternative 4 having the greatest decrease (7%). The effect of this change is expected to be minimal because 1) ample amounts of denning habitat would remain with at least 50% of lynx habitat in the analysis area (37% in SNF 10) in suitable condition. Forest Plan directs us to maintain at least 10% suitable habitat in LAUs. 2) Project design criteria for leave trees would maintain some suitable habitat components in harvested stands (see Appendix E). 3) Suitable denning habitat would remain well distributed through the area.

Proximity of denning to foraging – With ample amounts of foraging and denning habitat maintained with each alternative the proximity of these habitats should be sufficient to provide for lynx.

Connective habitat– The amount of habitat necessary for lynx movement in the analysis area would decrease with all alternatives, with alternative 4 resulting in the greatest decrease. The effect of this change is expected to be insignificant because 1) the majority (87%) of lynx habitat would remain suitable as connective habitat allowing for lynx movement throughout the analysis area and between

the analysis area and refugia habitat in the BWCAW, and 2) connective habitat would remain well distributed including in the Bogberry, Omaday and August Lakes area which was an area of concern identified during project planning and in the Fernberg area which bisects lynx refugia habitat.

Overall, the direct and indirect effect of proposed changes in lynx habitat with all action alternatives is expected to be insignificant. This is because important habitat components would remain abundant and well distributed. This means that ample habitat for lynx and important prey species would be maintained in this alternative.

Table 3.4-2. Lynx Habitat – Forest Condition Indicators

		2007		Acres and Percent of habitat in 2017[3]							
		Existing Condition [1]		Alternative 1 (no action)		Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
Indicators		**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Snowshoe hare habitat[4]											
Lynx Analysis Units	SNF 8	15,300	80	14,774	77	14,759	77	14,745	77	14,086	73
	SNF 9	24,068	73	22,783	69	22,680	69	22,760	70	22,323	68
	SNF 10	18,031	51	21,779	58	21,779	58	21,779	58	19,202	54
total		57,399	65	59,336	67	59,218	67	59,284	67	55,611	63
Red squirrel habitat[4]											
Lynx Analysis Units	SNF 8	4,097	21	4,236	22	4,120	21	4,030	21	3,792	20
	SNF 9	8,817	27	9,200	28	8,991	27	9,131	28	9,086	28
	SNF 10	16,167	45	17,347	46	17,297	46	17,297	46	16,479	46
total		29,081	33	30,783	35	30,408	35	30,458	35	29,357	33
Denning Habitat[4]											
Lynx Analysis Units	SNF 8	12,861	71	12,919	71	11,819	65	11,860	65	10,777	59
	SNF 9	19,120	63	19,846	65	17,962	59	18,335	60	17,881	59
	SNF 10	14,370	43	15,203	43	15,104	42	15,104	42	13,287	37
Total		46,351	55	47,968	57	44,885	53	45,299	54	41,945	50
Connective habitat[4]											
Lynx Analysis Units	SNF 8	18,124	94	18,349	95	17,225	90	17,224	90	16,169	84
	SNF 9	30,577	93	30,577	93	28,593	87	29,035	88	28,660	87
	SNF 10	33,881	95	33,881	95	31,378	88	32,577	91	31,368	88
total		82,582	94	82,807	94	78,278	89	78,836	90	76,197	87
		Acres		**Acres**		**Acres**		**Acres**		**Acres**	
Acres of snowshoe hare habitat in which within stand structure will be increased[3]											
Lynx Analysis Units	SNF 8	0		0		3,274		3,523		4,306	
	SNF 9	0		0		1,371		1,371		1,371	
	SNF 10	0		0		1,822		746		1,822	
total		0		0		6,413		5,640		7,499	

Data Source: [1] Existing condition for vegetation indicators are based on frozen August 12, 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.

Other Footnotes: [2] Includes proposed actions and cumulative actions

[3] Percent of forested lynx habitat on NFS lands (SNF 8 = 18,273 ac, SNF 9 = 30,390 ac, SNF 10 = 35,593 ac)

[4] Percent of lynx habitat on NFS lands (SNF 8 = 19,255 ac, SNF 9 = 33,039 ac, SNF 10 = 35,681 ac)

Human disturbance factors

Miles of low standard roads – Table 3.4-3 displays the miles of temporary and low standard roads that would result with each alternative. With all alternatives there would be an increase in the number of temporary and low standard roads with the highest increase in alternative 4. The effect of these changes in roads is expected to be minor because 1) the majority of the new roads would be temporary which would be decommissioned after use therefore effects would be short term, 2) New system roads and temporary roads would not be open for public use so disturbance and human related mortality as a result of these new roads is not expected, and 3) lynx currently persist in the area with the current level of low standard roads, and with the project areas adjacency to the BWCAW lynx can find refuge where roads are not a factor.

Table 3.4-3. Lynx Habitat – Human disturbance/Access Indicators

Indicators		2007 Existing Condition [1]	Miles of road in 2017 [3] Alternative 1 (no action)	Alternative 2	Alternative 3	Alternative 4
		miles	miles	miles	miles	miles
Miles of Temporary, OML 1, and OML 2 roads (Combined)						
Lynx Analysis Units	SNF 8	0, 3, 4 (7)	10, 3, 5 (17)	6, 3, 5 (14)	11, 3, 5 (19)	
	SNF 9	0, 14, 16 (30)	17, 15, 16 (47)	15, 15, 16 (46)	17, 15, 16 (48)	
	SNF 10	0, 23, 32 (55)	18, 24, 32 (73)	12, 23, 32 (68)	18, 24, 32 (74)	
total		92	137	128	141	

Data Source: [1] Roads indicator data for Existing Condition and alternatives are based on August 2007 road arcs coverage data.
Other Footnotes: [2]Miles of road where RMVs allowed includes OML 1and 2 cs, und, uatv and OML 1 cw. Action Alts data is from any proposals to decommission or add roads to the system. This figure does not represent the amount of cross-country use by snowmobiles.

Conclusion

In general all action alternatives there would have decreases in the amount of suitable habitat components, however, forest vegetative conditions would provide for sufficient lynx denning, foraging, and movement across the analysis area. All alternatives are in compliance with Forest Plan objectives for lynx (see Glacier BA). Action alternatives would improve habitat condition for hare by increasing within stand structure. The six gravel pits (0.6 acres) proposed in this project would have a minimal effect to lynx habitat.

High levels of open, low-standard roads would persist throughout parts of the analysis area maintaining a risk of lynx mortality. This situation will be improved through actions proposed in the Travel Management Project and effectively closing all temporary and OML 1 roads.

Another issue for lynx is providing foraging and denning habitat in close proximity to each other as well as maintaining habitat connectivity. Foraging (63% of the analysis area) and denning habitat

(50% of the analysis area) are and would remain well-distributed through out the project in all alternatives.

SNF 8 (Fernberg Corridor) is an important area for connectivity between the two areas of the Boundary Waters Canoe Area Wilderness (BWCAW). This project would maintain adequate connectivity to allow for movement between the BWCAW across the LAUs, due to the limited clearcut harvest in this area and the retention of areas not harvested to provide connections between the BWCAW to the north and south of the Fernberg Corridor.

3.4.6.2 Cumulative effects

Analysis of the direct and indirect effects showed that project alternatives would change the amount and location of suitable habitat components available on federal lands. However, the effect of these changes, as a result of the Glacier Project alone, would be minimal (see direct and indirect effects section above). This section looks at whether the incremental impacts of the Glacier Project when added to other past, present, and reasonably foreseeable future actions on all ownerships would result in significant or adverse cumulative effects to lynx in the analysis area. A list of the past, present and reasonably foreseeable future actions analyzed for this project can be found in Appendix C. Those specific projects that contribute to cumulative effects on lynx will be discussed below. This cumulative effects analysis relies on the following assumptions identified by the Lynx Conservation Assessment and Strategy:

- Lynx can persist in most situations with some level of human activity.
- Human activities and alteration of habitat decrease habitat quality and lynx use of habitat, but the thresholds are not known.
- Areas without high human activity levels are likely more favorable to lynx.
- Habitat connectivity is important to lynx conservation.

The FEIS for the Forest Plan predicted that with Forest Plan implementation, cumulative impacts would occur from lands outside of National Forest jurisdiction (Forest Plan FEIS Volume 1 pg 3.3.4-16). It predicts that management of vegetation on all ownerships would have cumulative impacts to lynx forest habitat. It also predicts that the greater potential for cumulative negative impacts would likely be the result of human disturbance and access. Three indicators are used help to assess these cumulative impacts as well as to assess compliance with Forest Plan direction. More information about these indicators can be found in the "Analysis Methods" section above. In brief, the indicators are:

Indicator	Why used?
Amount of change to unsuitable condition on Federal lands	• Assess impacts to lynx habitat – forest condition • To measures Forest Plan Standard S-WL-1
Amount of unsuitable habitat on all ownership	• Assess impacts to lynx habitat – forest condition • To measures Forest Plan guideline G-WL-3
Road and compacted trail density on all ownership	• Assess impacts from human disturbance/access • To measures Forest Plan guideline G-WL-8

Cumulative impacts to lynx habitat – forest condition

In general, past land management activities on all ownerships have shaped the habitat that exists today for lynx in the analysis area. On federal lands, past projects that changed forest conditions, such as the Rusty Diamond, Tomahawk, Dunka, Echo Trail Projects, as well as past fuels reduction projects are tracked in our CDS database of forest stands. The changes in vegetation type and age that resulted from those projects is reflected and analyzed in the existing and alternative 1 forest habitat conditions for the Glacier project. This change in suitable habitat on federal lands is also reflected in the "Currently Unsuitable Lynx Habitat on All Ownerships" indicator below. All past and planned vegetation management on other ownership listed in Appendix C is also taken into account in the "Currently Unsuitable Lynx Habitat on All Ownerships" indicator. Due to their small size, recent wildfires within the analysis area have had very little effect on lynx habitat in the area. Wildfires within lynx refugia habitat (Turtle Lake WFU and the Little Gabbro Lake fires) along with planned prescribed burns described in Appendix C likely have or will result in improved habitat conditions for snowshoe hare and thus have beneficial impacts on lynx. The following projects would result in no measurable change to lynx forest habitat conditions but may have impacts as a result of human access and disturbance and will be discussed in that section: New private developments, Hunter walking trails, mining proposals, Highway 1 reconstruction, Travel Management project, non-native invasive species, and special use requests. The South Kawishiwi Summer Home Land Exchange would result in a loss of approximately 425 acres of lynx habitat under federal ownership in LAUs SNF 9 and 10. However, this acreage currently developed with cabins and suitability for lynx is marginal. It's anticipated that if the exchange goes through habitat suitability would remain marginal under non-federal ownership. Although most is outside the scope of this analysis, in exchange an additional 1,200 acres of lands would be acquired by the Forest Service. Most is located in LAUs SNF 4, 12 and 16, however 148 acres are located in LAU SNF 10 (information from the Biological Assessment for the South Kawishiwi Summer Home Group Land Exchange Project).

Cumulative change to unsuitable condition on NFS lands.
This indicator (table 3.4-4) is used to measure S-WL-1 which states that *management activities on NFS lands shall not change more than 15% of lynx habitat on NFS lands within an LAU to an unsuitable condition within a 10-year period*. This indicator measures the cumulative change of lynx habitat within a decade. The baseline for each LAU was set to zero at the time of plan implementation

(July 2004). The purpose of this Forest Plan Standard is to place limits the amount of allowable change to lynx habitat as a means to maintain adequate amounts of suitable habitat on federal lands and avoid adverse impacts. Table 3.4-4 shows that all alternatives remain below this standard (with alternative 4 resulting in the greatest change to unsuitable).

Table 3.4-4. Cumulative change to unsuitable habitat condition in 10 years on NFS lands

LAUs	Existing Condition 2007 [1]		Change to unsuitable condition in a 10 year period (first decade of Forest Plan implementation, 2004-2014)											
			Alternative 1 (no action)			Alternative 2			Alternative 3			Alternative 4		
			Present Actions[5]	Total Change		Proposed Change[3]	Total Change[4]		Proposed Change[3]	Total Change[4]		Proposed Change[3]	Total Change[4]	
	Acres	% [2]	Acres	Acres	% [2]	Acres	Acres	% [2]	Acres	Acres	% [2]	Acres	Acres	% [2]
Indicator 12: Cumulative change to unsuitable condition in 10 years on NFS lands.														
SNF 8	308	1.4	165	472	2.1	1,124	1,598	8	1,125	1,270	8	2,180	2,652	14
SNF 9	0	0.0	0	0	0	1,984	1,904	6	1,542	1,542	5	1,917	1,917	6
SNF 10	0	0.0	1,316	1,316	4	2,503	3,819	10	1,304	2,620	7	2,513	3,829	10

Data Source: [1] Existing Condition based on August 12, 2007 Frozen CDS data.
Other Footnotes: [2] Percent of lynx habitat on NFS lands (SNF 8 = 19,255 ac, SNF 9 = 33,039 ac, SNF 10 = 35,681 ac),
[3] Glacier units only
[4] Includes proposed actions and cumulative actions (Rusty Diamond, Echo Trail, Dunka, and Tomahawk projects) to date on federal lands within each LAU.
[5] Reflects past actions since FP Implementation began that have resulted in a change to unsuitable.

Currently Unsuitable Lynx Habitat on all ownerships

This indicator (table 3.4-5) provides a measure of Forest Plan guideline G-WL-3 which states "*limit disturbance within each LAU on NFS lands as follows: if more than 30% of the total lynx habitat (all ownerships) within an LAU is currently in unsuitable condition, no further reduction of suitable condition should occur as a result of vegetation management activities by National Forest*. Unsuitable habitat is generally recently harvested areas where the age of the stand is between zero and three years. Based on the data in table 3.4-5, adverse cumulative effects are not expected from cumulative vegetation management activities in LAUs SNF 8, 9 or 10. All alternatives would maintain the amount of unsuitable habitat well below this threshold. This ensures that lynx are able to continue to find adequate foraging and denning habitat regardless of ownership and that adequate connective habitat for lynx movement would be maintained within and between LAUs and between LAUs and refugia habitat in the BWCAW.

Table 3.4-5. Lynx habitat currently in an unsuitable condition on all ownerships									
Lynx Analysis Units	Total Lynx Habitat on all ownerships (acres)	Currently Unsuitable On all ownerships		Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
		Acres	%	Acres	%	Acres	%	Acres	%
Indicator 11: Currently Unsuitable Lynx Habitat on all ownerships									
SNF 8	37,421	1,127	3.0	2,251	6.0	2,252	6.0	3,307	8.8
SNF 9	65,733	1,973	3.0	3,957	6.0	3,515	5.3	3,890	5.9
SNF 10	43,607	1,255	2.9	3,758	8.6	2,559	5.9	3,768	8.6
Data Source: [1] Currently Unsuitable Lynx Habitat on all non-NFS Land: percent of LAU in lynx habitat. Data source: 1995 TM Scene with change detection from 2001 through 2006; appropriate ownership layer. [2] Glacier harvest plus currently unsuitable on all ownerships.									

Cumulative impacts to lynx habitat – human access

As stated in the Programmatic BA, the greatest potential for cumulative negative impacts and pressure on lynx recovery is likely to be the result of human access. See the "Effects Common to All Action Alternatives" section above for details regarding the part that roads and trail play in impacts of human access into lynx habitat. New private developments such as the Black Wolf Lots could potentially impact lynx by increased human access in this area of SNF 8. However, the impact of that is expected to be minor as lots are located just outside of the city of Ely in a section of SNF 8 that already contains a higher level of human activity. The sale and potential development of Potlatch lands could have a greater impact, however currently; future development plans of these lands are unknown. Hunter walking trails planned in the Greenstone Lake Area would not likely contribute cumulative impacts to lynx because trails are already in existence and already used primarily during the hunting season. Mineral exploration may contribute slightly to cumulative effects however is not anticipated to contribute significantly in the Glacier area for the following reasons: mineral activities occurring now are slatted for completion in March of 2010. There may be a slight overlap in time however most of the effects from exploration activities would be completed before much of the Glacier project is implemented thus lessoning the effects; Also access to drill sites is via temporary road which would be decommissioned after use. Highway 1 bisects LAU SNF 10. However, adverse cumulative effects from the highway 1 reconstruction project are not expected because although the highway 1 project would increase the risk of lynx mortality due to roads (Biological Opinion for the Highway 1 project), the Glacier project would maintain ample amount of suitable habitat so there would be no compounding effects from these two projects. Cumulative impacts could result from the Travel Management project and special use requests. The effect of these projects is considered and analyzed below with the Cumulative road and compacted snow density indicator.

Cumulative Road and snow-compacted Trail density.
This cumulative indicator (table 3.4-3) is used to measure Forest Plan guideline G-WL-8 which states that *within LAUs generally maintain road and snow-compacting trail densities below 2 miles per square mile to maintain the natural competitive advantage of lynx in deep snow. Where total road and regularly-used snow-compacting trail densities are greater than 2 miles per square mile and coincide*

with lynx habitat, prioritize roads for seasonal restrictions or reclamation in those areas, where practical or feasible. In this guideline "roads" include all ownerships of classified and unclassified roads and "regularly-used trails" are those that are used most years for most of the snow season. Most of the other Glacier road and trail proposals (7.5 miles of existing winter routes) did not change road and trail density since they already exist and are already figured into the overall density. The only proposal that would increase road density is constructing new system road to provide long-term access to state and federal land. This increase would be offset by the road decommissioning in the Travel Management project. See Transportation Section 3.16. While SNF 8 and 9 would remain above 2 miles per sq. mile in all action alternatives, road densities in the analysis area (SNF 8, 9 and 10) would decline slightly as a result of the proposed road decommissioning in the Travel Management Project. Most of this road density is private, township, county and state roads which are outside the jurisdiction of the Forest Service. Private land development and road building would continue as would recreational demand in these LAUs. These activities could reduce the lynx competitive advantage and increase the risk of mortality. Lynx in this area likely benefit from the areas proximity to refugia habitat in the BWCAW where road/trail density and human activity is lower.

Table 3.4-6 Road and snow-compacted Trail Density – mi2/mi2[3]

Indicators		2007	Miles of road in 2017 [3]			
		Existing Condition [1]	Alternative 1 (no action)	Alternative 2	Alternative 3	Alternative 4
		miles	miles	miles	miles	miles
Lynx Analysis Units	SNF 8	5.13		5.05		
	SNF 9	3.26		3.16		
	SNF 10	1.90		1.85		

Data Source: [1] Roads indicator data for Existing Condition and alternatives are based on August 2007 road arcs coverage data.

Other Footnotes: [2]Miles of road where RMVs allowed includes OML 1and 2 cs, und, uatv and OML 1 cw. Action Alts data is from any proposals to decommission or add roads to the system. This figure does not represent the amount of cross-country use by snowmobiles.

[3]Road and trail density based on linear miles per square land mile and is a cumulative measure that includes non-federal roads and the Forest-wide Travel Management proposals. The TM project proposes to decommission 2.6 miles, 6.1 miles, 3.2 miles in LAU 8, 9 and 10, respectively.

3.4.7 Determination of Direct, Indirect and Cumulative Effects

All alternatives may effect but are not likely to adversely affect the Canada lynx and are not likely to adversely modify proposed Critical Habitat. This is because 1) sufficient amounts, quality, and distribution of forest habitat for lynx and its prey would remain; 2) adequate amounts of connective habitat for lynx movement would remain within LAUs and between LAUs and refugia habitat in the BWCAW; 3) changes to road and trail systems would be small, temporary roads would be decommissioned after use and new system roads would not be open to public use; 4) road/trail density would decrease with all action alternatives; 5) primary constituent elements of critical habitat would be maintained; and 6) all alternatives comply with all applicable Forest Plan management direction related to Canada lynx. These determinations are based on comprehensive analysis conducted in the Glacier Biological Assessment and summarized in this section of the EIS.

3.4.8 Consultation with United States Department of the Interior (USDI) Fish and Wildlife Service

The Forest Service has been in consultation with the Fish and Wildlife Service (FWS) throughout the Project planning. Our formal request for consultation and concurrence was sent to the FWS on June 9, 2008. They have concurred with our analysis methods and determinations of effect (concurrence letter received 12, June, 2008). Consultation specific to the Glacier Project is documented in the project file. It includes emails, telephone calls, field review notes and meeting notes including the submission of the Glacier Project BA to the FWS.

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